Zero Retries issue 0192 2025-03-07

Zero Retries is an independent newsletter promoting technological innovation that is occurring in Amateur Radio, and Amateur Radio as (literally) a license to experiment with and learn about radio technology. Radios are computers - with antennas! Now in its fourth year of publication, with 2500+ subscribers.

About Zero Retries

Steve Stroh N8GNJ, Editor

Web version of this issue - https://www.zeroretries.org/p/zero-retries-0192

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Request To Send

Commentary by Editor Steve Stroh N8GNJ

Paid Subscribers Update

My thanks to **Ron Sparrow N7RDE** for *renewing* as an **Annual Paid Subscriber** to Zero Retries this past week!

My thanks to **Thom Proehl K7FZO** for *upgrading* from a free subscriber to Zero Retries to an **Annual Paid Subscriber** this past week!

My thanks to **Charles Riley G4JQX** for one year of being a **Paid Subscriber** to Zero Retries as of this past week!

My thanks to **Prefers to Remain Anonymous 22** for *two* years of being a **Paid Subscriber** to Zero Retries as of this past week!

Financial support from Zero Retries readers is a significant vote of support for the continued publication of Zero Retries.

# # #

Bias Towards the Future

I had two unrelated conversations this week about "the state of Amateur Radio", and in both conversations I finally put into text and words something that I had unconsciously adopted as a frame of reference in my writing in Zero Retries - a bias for the future, rather than the present or the past. Basically, in envisioning the future of Amateur Radio… "legacy" Amateur Radio modes, operations, preferences, etc. will soon enough be irrelevant. In hoping to secure a future for Amateur Radio, what truly matters is the modes, operations, preferences, etc. *of the current, and future generations*.

Trying to evangelize interest for legacy modes (I won't single one out), or legacy operations (again, I won't single one out) or legacy preferences… is in my opinion, wasted effort. Instead, what's really needed to secure Amateur Radio's future is to identify what in Amateur Radio is *of interest to the current and future generations*. Then embrace, promote, and develop *that*. For example… this generation uses text messaging as a primary method of communication, thus the explosion of interest in Meshtastic (and perhaps MeshNode), Ribbit, JS8Call, and other text message systems that don't require communications infrastructure.

The Annual Trek to Puyallup

Solely out of curiosity, and an excuse for a change of scenery from (beautiful) Bellingham and Whatcom County, tomorrow is the annual Mike & Key (Amateur Radio Club) Electronics Show & Swap Meet at the Western Washington Fairgrounds in Puyallup, Washington. *AKA, the Puyallup Hamfest*.

"Puyallup" is the only large hamfest (there are no seminars, etc. so it's not really a conference) in Western Washington. Having lived in Western Washington for 38 years now, going to Puyallup has become a ritual. I don't need any more ephemera / projects to work on in N8GNJ Labs. It's really rare to see anything at Puyallup that isn't *trailing* edge technology or *very* vintage, but there are occasional surprises. Of course there are familiar faces, and interesting conversations. And the last few years, I've been watchful for relevant material for Digital Library of Amateur Radio & Communications (DLARC) that is free or inexpensive. Last year I found a number of printed proceedings from Amateur Radio microwave conferences that are now online in DLARC. So, if you're a Zero Retries reader attending Puyallup, watch for the blue Zero Retries hat peeking slightly above the crowd.

# # #

Image courtesy of HamSCI

HamSCI 2025

Next week my wife Tina KD7WSF and I will travel to Newark, New Jersey to attend HamSCI 2025. I'm looking forward to learning a lot more about HamSCI's overall mission, and I'm particularly looking forward to this rare Amateur Radio event where younger folks, mostly students, are in the majority, and all with technical, engineering, or scientific backgrounds.

I was able to secure a "poster session" to evangelize the IP400 Network Project to the HamSCI attendees. I think I will be able to make IP400 interesting and relevant to them as an Amateur Radio data communications system that (will be) developed in the 21st century, *solely with 21st century technology*.

There are several Zero Retries readers that requested to meet up at the event, and Tina will enjoy being back in "the old country" where she grew up.

# # #

Have a great weekend, all of you co-conspirators in Zero Retries Interesting Amateur Radio activities!

Steve N8GNJ

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IP400 Update - 2025-03-07

By Steve Stroh N8GNJ

I've written several articles about the IP400 Network Project ("Intelligent Protocol" on the "400" MHz Amateur Radio band) since it was announced 2024-01-17 in ***Zero Retries 0185****. That writing has grown fragmented as the project has rapidly evolved. This article consolidates my writing, and is* ***my*** *perspective as a (conceptual) contributor and evangelist for the IP400 Network Project.*

The authoritative details about the IP400 Project can be found at:

- *The organizational sponsor of the IP400 Network Project is* ***Alberta Digital Radio Communications Society (ADRCS)*** *- https://adrcs.org*
- ***IP400 Network Project*** *page - https://adrcs.org/adrcs/ip400-network-project/*
- ***ip400 repository*** *on Github - https://github.com/adrcs/ip400*
- ***IP400 email list*** *- https://groups.io/g/ip400*

IP400 Network Project Abstract

The goal of the IP400 Network Project is to develop a next generation data communications system by Amateur Radio for Amateur Radio. Features include higher speeds (minimum 100 kbps), robust modulation (eventually OFDM) and forward error correction, automatic discovery and routing to form peer to peer mesh networks (interoperable with AREDN), and ability to transport widely varying data types, from short text messages, through digital voice and video, including AX.25 and TCP/IP. IP400 will offer an adapter (Supernode) for repeaters to allow them to interoperate with IP400 user nodes. An initial IP400 radio is expected to be available in mid 2025. IP400 is in very active development and is sponsored by the Alberta Digital Radio Communications Society.

Background on the IP400 Network Project

Martin Alcock VE6VH - Introduction to the IP400 Project - VE6VH

Steve Stroh N8GNJ - Introduction to the IP400 Project - N8GNJ

Both of these articles are "precursor" perspectives on what motivated each of us to *create* (VE6VH) and *get involved* (N8GNJ) with the IP400 Network Project.

Inspiration for the IP400 Network Project

There are *four primary inspirations* for the scope of the IP400 Network Project - AREDN, Amateur Radio VHF / UHF repeaters, new technologies, and the opportunity to attract new Amateur Radio Operators that prefer data modes.

Amateur Radio Emergency Digital Network (AREDN) Project

In many ways, AREDN is the ideal Amateur Radio network system as it incorporates automatic mesh network (discovery and routing) techniques, high speeds (10 Mbps and faster), and native support for TCP/IP. But AREDN only operates on microwave frequencies (2.x GHz and 5.x GHz) which is not amenable to deployment in many terrains without affordable, accessible high locations for hub nodes.

Amateur Radio VHF / UHF Repeaters

Since the 1950s,[1] VHF / UHF repeaters have been used in Amateur Radio to allow reliable operation on VHF / UHF by base stations, mobile stations, and portable radios. But with only a few exceptions, VHF / UHF repeaters have not been used for data communications, only voice (including digital voice). In the 2020s, repeaters are increasingly falling "quiet" from lack of use, creating an opportunity to adapt repeaters to support wide-area data communications networks for Amateur Radio.

New Technologies

In the 2020s, vastly improved radio, computer, and software technologies have become available that make it feasible to create a new data communications *system* such as IP400 *by* Amateur Radio *for* Amateur Radio. Such technologies include highly integrated radio modules, powerful, inexpensive embedded computers, and increasing sophistication of software defined radio technology… emphasis on *software*, including vast libraries of open source code for Amateur Radio, and software defined radio frameworks such as GNU Radio.

New Generations of Amateur Radio Operators

Any communications system is "just another technology" without a user base to *use* a new communications system. It's my… and others… perspective that there is a new generation of (current, and potential) Amateur Radio Operators that would actively embrace and use data communications in Amateur Radio if there were a system that was easier to use than current data communications systems available in Amateur Radio, that works reliably, embraces current network technologies, and is designed to support modest stations.

Key Differences of IP400 Network System Versus Previous Data Communications Systems

- Use of Amateur Radio 420-450 MHz band for better range (compared to microwave, including ability to use higher power transmitters).
- Higher speeds than previously achieved with Amateur Radio VHF / UHF data communications systems - minimum 100 kbps, but scalable to higher speeds.
- Integration and automatic routing with AREDN nodes / network *when available*.
- Automatic routing via IP400 enabled repeaters (SuperNodes) *when available*.
- Improved reliability by use of a robust modulation system that will include Forward Error Correction and eventually Orthogonal Frequency

Division Multiplexing (OFDM) in the *radio* domain, not the audio domain.

- "Transparent" protocol that will encapsulate other systems / technologies for transport through an IP400 network. Examples include:
  - TCP/IP
  - AX.25
  - Amateur Radio voice systems (likely incorporating Multi Mode Digital Voice Modem - MMDVM)
  - Amateur Radio data systems such as telemetry, APRS, short messages, bulletins, file transfers, email.
  - Video
- Designed for use on small, inexpensive, embedded computers (such as Raspberry Pi) that can be dedicated to IP400 operation.

Overall Goals of the IP400 Network Project

- Automatic mesh networking / discovery with mesh (node advertising) compatibility with AREDN.
- Open source provided wherever possible.
- Meshnode Raspberry Pi HAT units to be available assembled projected for mid-2025. Meshnodes will transmit at 100 mW power, but can be easily interfaced to external power amplifiers.
- Supernode for adapting FM voice repeaters to be compatible with IP400 (retains ability to use FM voice) is in development, along with other IP400 modules.
- First in-person demonstration at Pacificon (San Ramon, California) 2025-10-10 thru 12.
- **SAFAUSR** (Silly Accommodation for Arcane US Regulations) mode. Currently US Amateur Radio regulations for data communications on the 420-450 MHz band limit the maximum bandwidth to 100 kHz and 56,000 symbols per second. (Other countries, and especially Canada, have no such limitations.) As a potential alternative to SAFAUSR in the US 420-450 MHz band, the radio chipsets in use for IP400 nodes can also be used in the 902-928 MHz band, where SAFAUSR isn't needed.

Stretch Goals of the IP400 Network Project

- "Special Mode" in development; powerful modulation / networking method never before used in Amateur Radio.
- Integrated unit - computer, IP400 module, power amplifier.
- Make IP400 available on other Amateur Radio VHF / UHF bands.
- Fully Software Defined Transceiver capability using I+Q interfaces of various radio chipsets that are / may be used for future IP400 units.

Supporting the IP400 Network Project

Technical help is needed for full development of IP400, including:

- A background in C, writing code for a Raspberry Pi and / or ST microcontrollers.
- FPGA design in Verilog would really be helpful for development of the Supernode (repeater controller).

If you have these capabilities and are interested in helping the IP400 Network Project, please contact Martin Adcock VE6VH - ve6vh@adrcs.org.

If you would like to financially support the development work of the IP400 Network Project (or are in the Alberta / Pacific Northwest region and want to support the ADRCS Network), go to https://adrcs.org/adrcs/ and click the **Join** button in the upper right corner of the page.

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IP400 Network Project Frequently Asked Questions v1.1

By Steve Stroh N8GNJ

Q. What is the IP400 Network Project? The Elevator Pitch?

- IP400 Network Project is a next generation *data communications* system by Amateur Radio for Amateur Radio.
- Higher speeds (minimum 100 kbps).
- Robust modulation including Forward Error Correction (FEC).
- Automatic, dynamic discovery and routing to form peer to peer mesh networks.
- Ability to transport widely varying data types, from short text messages, through digital voice and video, including AX.25 and TCP/IP.

- IP400 will offer an adapter (Supernode) for repeaters to allow them to interoperate with IP400 user nodes.
- Initial IP400 units are expected to be available in mid 2025.

Q: Meaning of IP?

A. **I**ntelligent **P**rotocol is being developed to take full advantage of this new generation of radio hardware for faster, more flexible Amateur Radio data communications.

Q. Meaning of 400?

A. The first several IP400 units will be for the "**400**" MHz Amateur Radio bands. In the US - 420-450 MHz, Canada 430-450 MHz, Europe, 430-440 MHz, etc. The choice of this band is a limitation of radio chipsets that were chosen for *initial, rapid, cost-effective development* of IP400 units. The long term goal is to offer IP400 units for all Amateur Radio VHF / UHF bands, which will require additional development to use different radio chipsets.

Q. Network Project?

A. Each IP400 radio will be capable of auto discovery and automatic routing mesh networking with other IP400 units. If an ARDEN node is available, an IP400 node can connect to it and AREDN nodes and IP400 nodes will be visible and accessible to each other. If an IP400 enabled repeater(s) is accessible, IP400 nodes can use that to create an extended network in addition to the mesh network. In addition IP400 Supernodes for repeaters can make use of additional options to interoperate with other repeaters with Supernodes.

IP400 units will support AX.25 and TCP/IP (initially, IPv4 and IPv6 later) networking using encapsulation. An IP400 radio's host computer can run an AX.25 stack, the IP400 protocol will encapsulate AX.25 packets, through the IP400 network, to the destination IP400 radio, which will unpack the AX.25 packets and pass them to that host computer's AX.25 stack.

Q. Why / how is this different from other Amateur Radio VHF / UHF radio projects?

A. IP400 units use radio chipsets that are optimized for *data*, and reasonably fast data - minimum of 100 kbps.

Q. How is this different from a Software Defined VHF / UHF Transceiver (SDT) like the LimeSDR Mini 2.0?

A1. SDTs such as the LimeSDR Mini 2.0 are general purpose devices that operate over a very wide frequency range with very low transmit power. Typically the very complex GNU Radio software is required to make use of such units.

In contrast, IP400 units are designed for *Amateur Radio* use by Amateur Radio *Operators* for the *Amateur Radio VHF / UHF bands* for reasonably fast data communications. It's planned that later versions of IP400 units will have an integral power amplifier at typical Amateur Radio power levels - 10 / 25 / 50 watts. Different modes in IP400 units will be simple to use - select the radio type / mode from a menu.

A2. Later, more capable IP400 units will, similar to the LimeSDR Mini 2.0, be a fully software defined transceiver using an I+Q interface coupled with a Field Programmable Gate Array (FPGA) and a host computer. For such use, it's expected that software developers will port radio / mode applications such as DMR, 9600 bps FSK packet radio, and almost any other voice or data mode to run on IP400 units.

Of course, it's hoped that someone will develop a driver to port GNU Radio to the later, more capable IP400 units so that GNU Radio software modules can be used on IP400 units (within the limitations of the radio chipset).

Q. Can IP400 units do voice?

A. Yes. It's intended that the IP400 "native" voice mode will be M17 which is open source, so "easily" ported to IP400 units. In the later, more capable IP400 units, other voice modes can be used by loading applicable software such as DMR, FM, SSB, etc. IP400 units communicating with other IP400 units, voice will be just one realtime bitstream of many potential realtime bitstreams including video, high priority telemetry, command and control, etc.

Q. Open Source?

A. Software, protocol, etc. will be open source.

Q. When?

A. Initial IP400 units are projected to be available in mid 2025.

Q. Price?

A. *There be dragons!* Many Amateur Radio projects have floundered or been attacked for prematurely mis-estimating what turned out to be a higher actual price. Realistic price estimates will be released when the project has progressed for at least a few months.

Q. Why use a Raspberry Pi as the host computer?

A. In general, the more functionality of a radio system that can be put into an embedded, general purpose computer results in a more flexible and less expensive system.

Raspberry Pi computers work well, are reasonable priced, they're (once again) widely available (worldwide), and they're incredibly well supported by the Raspberry Pi Foundation. Raspberry Pi computers (and modules) are generally the least hassle / most common host computer available for dedicated applications in Amateur Radio. All other platforms have varying degrees of available, support, cost, etc.

Especially in the later, more capable IP400 units, to maintain high performance / high speed, the radio | FPGA | host computer connectivity must be high performance and low latency (in comparison to a more typical USB interface to a PC, etc.) The Raspberry Pi 5 supports high speed interfaces including PCIe. Potentially, an embedded Raspberry Pi 5 Compute Module could be used for even better integration, higher performance, and cost-effectiveness.

Another recommendation for the Raspberry Pi 5 is native video capabilities - it has an input for an inexpensive camera, and native H.264 video decoding. And, no hassles with adding Wi-Fi or Bluetooth - that's also built in. *And* the RPi 5 has a built in real time clock! Those are all features "included for free"

when a Raspberry Pi (5) is used as a IP400 radio's host computer, that the IP400 Network Project *doesn't* have to engineer or create drivers for.

Q. How can I play along?

A1. Steve Stroh N8GNJ will be reporting regularly about IP400 Network Project developments in his weekly Zero Retries newsletter.

A2. For developers, check out the IP400 Public GitHub Repo.

A3. For general conversation, join the IP400 Network Project email list.

A4. Prototype development (2025-01) is being done with a NUCLEO-WL33CC2 (radio) development board. See this email list posting for details. Note that the prototype work is different hardware than the initial IP400 units.

Q. Will IP400 be legal in the US?

A. It is planned that IP400 will implement a **SAFAUSR** mode for IP400 - *Silly Accommodation for Arcane US Regulations*. SAFAUSR mode will adhere to the current US limitations for data modes in the US 420-450 MHz band - maximum bandwidth of 100 kHz and maximum of 56,000 symbols per second. In other countries, IP400 can operate at much faster data rates in their respective 400 MHz bands.

Q. How can I support the IP400 Network Project?

A. Technical help is needed for full development of IP400, including:

- A background in C, writing code for a Raspberry Pi and / or ST microcontrollers.
- FPGA design in Verilog would really be helpful for development of the Supernode (repeater controller).

If you have these capabilities and are interested in helping the IP400 Network Project, please contact Martin Adcock VE6VH - ve6vh@adrcs.org.

If you would like to financially support the development work of the IP400 Network Project (or are in the Alberta / Pacific Northwest region and want to support the ADRCS Network), go to https://adrcs.org/adrcs/ and click the **Join** button in the upper right corner of the page.

Q. How can I arrange for an interview for an article, podcast, YouTube video, etc.?

A. Fill out the ADRCS Contact Form.

# # #

IP400 Network Project - Frequently Asked Questions v1.1 - updated 2025-03-06

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Trends I Hope to See in 2025 (and Beyond) - Part 2

By Steve Stroh N8GNJ

These are some trends, technologies, projects, organizations, etc. that I ~~expect~~… hope to see in 2025 and beyond. As usual, my perspective for these is mostly US-centric. It will be interesting to look back at these articles in January, 2026.

Part 1 appeared in **Zero Retries 0187**.

A few updates since that article:

- Completion of FCC Docket 16-239 - This isn't going to happen without some*one* or some *organization* submitting a Petition for Rulemaking - see **Zero Retries 0188** - Reality Check on Updating FCC Regulations for Amateur Radio VHF / UHF.
- The debut of the Kenwood "TM-D720GA" - We now know at least Kenwood's designated model number for this radio - TM-D750A.

Lack of an Amateur Radio Software Defined VHF / UHF Transceiver

The biggest Amateur Radio manufacturers… Alinco, Icom, Elecraft, FlexRadio, Kenwood, Yaesu all seem *determined* to miss the opportunity to do a real Software Defined Transceiver for VHF / UHF. They have built some really elegant "SDR" radios for HF, and Icom had some real innovation in the IC-905, but all these new radios don't have a significant data capability, and all except FlexRadio don't grasp the concept of running user-defined software, such as the innovative FreeDV digital voice mode designed for HF *in* the radio.

If those biggest manufacturers can't get this concept for their very high end HF radios, there's approximately zero chance that they'll extend themselves to create a Software Defined Radio for VHF / UHF. I'm all for irrational exuberance… but there doesn't seem any hope for this idea… *from one of these "mainstream" Amateur Radio manufacturers*. They're just too invested in the paradigm of 20th century radios - hardware in a box.

We might have had such a radio in the RPX-100, a project by the Austrian Radio Amateur Society (OEVSV) funded by a grant for ARDC to develop a Software Defined Transceiver for 50 / 144 / 440 MHz. They had a lot of the right ideas:

- The core of the radio was a LimeSDR software defined transceiver board. Any mode, nearly any frequency. OEVSV chose to implement the nearly universal worldwide 50 MHz, 144 MHz, and 440 MHz bands.
- The compute engine was a Raspberry Pi.

- They developed a power amplifier that accepted the very low transmit power of the LimeSDR to reasonable power levels usable in typical Amateur Radio.

There's nothing stopping any interested group or company from following this approach… but no one seems interested.

The last issue with the RPX-100 approach is that there are many elements of the software required to make such a unit usable that *already exist in GNU Radio* - FM, SSB, etc. It (seems to me) an organizing and packaging task to assemble various modes in GNU radio and package it into a menu system. Want your "RPX-200" to run FM for the weekly net - that's Menu Item 1. Want your "RPX-200" to run 19200 bps MMDVM-TNC for accepting connections to your BBS - that's Menu Item 2. Etc.

DigiPi Gets Wider Acceptance

DigiPi is a remarkable system. The tagline of KM6LYW's YouTube channel is *Reimagining radio in the information age*. You can easily load up a Raspberry Pi, optionally some specific hardware, connect a radio, and be up and running on Amateur Radio data modes quickly. Most notably, DigiPi is designed to be used remotely - on an external laptop, tablet, desktop, or even a mobile phone.

I think that DigiPi version 1.9-3 will be even better received because it will add support for the "All In One Cable" - AIOC. AIOC is a radically simplified audio adapter (and programming adapter) designed for certain Amateur Radio portable radios that just plugs in to the radio and uses USB-C to communicate with the host computer - in this case a Raspberry Pi running DigiPi. This will be about the simplest possible way to get running on data modes using DigiPi (other than some radios that have an integral audio adapter, which is explained in the DigiPi documentation). With DigiPi (or two) Raspberry Pi and a portable radio (or two), you can easily and inexpensively experiment with data communications over radio.

Amateur Radio has needed such a "starter kit" for easy experimentation with data modes, and I think the combination of DigiPi, AIOC, and an inexpensive portable radio is a good enough "starter kit".

ka9q-radio / ka9q-web Gets Wider Acceptance

ka9q-radio and its more user-friendly follow-on ka9q-web is a remarkable new paradigm in Amateur Radio (and radio technology in general) - an "entire band" receiver based on (relatively) inexpensive Software Defined Receiver hardware and a generic host computer, including Raspberry Pi 4, and now Raspberry Pi 5. Not sequential scanning, not "display the waterfall and click", but receiving all channels in a band, *simultaneously*.

As ka9q-radio receives more exposure, the interest in it grows. Thus a new vendor may well find a market in developing an integrated ka9q-radio *system* - receiver, computer, software, preconfigured and integrated, such as KiwiSDR 2.

Deathwatch of Stagnant Organizations

I can think of several organizations, which I won't name, that have unfortunately continued to exist beyond their overall utility to Amateur Radio. The danger signs of such organizations are lack of turnover in leadership and lack of recent significant accomplishments relating to their founding purposes. All of the organizations I'm thinking of were founded in the 20th century and really haven't made the transition to the paradigms of the 21st century such as embracing new technologies, open content, virtual meetings, international involvement, and evangelism for their founding purposes.

Fortunately, a counter development to stagnant organizations is that it's easier than ever to form and fund new organizations, even formal charitable organizations which used to require the services of a legal firm and significant expense - now it's (conceptually) as simple as filling out a form and a small payment.

I think that any significant Amateur Radio project / service needs either a business, or an organization to champion it. Then that business or organization needs to deliver results - support and grow its audience, including maintaining its own focused communications channels and outward focused evangelism.

A Noticeable Tipping Point in Demographics of Amateur Radio

From my observations of Amateur Radio for Zero Retries2, I just don't see any significant uptick in the demographics of "classic" areas of Amateur Radio. Obviously, such classic areas of interest such as HF voice, use of Morse Code (CW), DXing, contesting, etc. will continue, but it's my guess that they will steadily, and eventually, *noticeably* decline as my generation (which is the most enthusiastic about these classic modes of operation) ages out.

What I am seeing as a result of my writing in Zero Retries is a steady increase in Hackers, Makers, IT professionals interested in networking, university (Engineering) students, and those just generally interested in radio communication and experimentation enter Amateur Radio. The interest of this new population in Amateur Radio (again, *my* observations) tends to skew towards data modes (messaging) rather than voice, activities that they can integrate with their active lifestyle such as Summits on the Air and Parks on the Air, more experimentation with software rather than building up hardware, and building networks such as Meshtastic.

Open Content In Amateur Radio Media

Free ***wins***. More importantly, offering open (free) content means that it's accessible by any *one*, any *where*, at any *time* who is curious about Amateur Radio. My touchstones of this trend are:

- The many Amateur Radio YouTube channels. While there's a lot of dreck, there are some real gems that consistently inform and engage about areas of Amateur Radio that are of interest to the current and future generations. In my opinion, the very best Amateur Radio YouTube channel is Tech Minds by Matthew Miller M0DQW. The production values are excellent, the selected topics are timely and interesting and the focus in on the stated topic instead of pontificating with "history" and personal opinions to "pad out" the length of the video for potential additional revenue.

- Surrey Amateur Radio Communications excellent newsletter The Communicator. Given that The Communicator is regularly over 100 pages, I call it a newsletterzine. The content is a good mix of operating, tech, and hands-on. In my opinion, it's easily the equal of the late CQ Magazine (minus the printed contest results which were never of any interest to me). I have no idea how SARC manages to put out such a great publication solely as a volunteer labor of love… but I hope to ask them when I begin attending some of their meetings in the coming months.

- 73 Magazine, now part of the Digital Library of Amateur Radio & Communications (DLARC). I regularly cite that despite having ceased

publication in 2003, 73 is more relevant to the current and future generations of Amateur Radio Operators than current magazines that are restricted behind paywalls. You can read every issue, every article published in 73. While the content of 73 predates current trends such as Software Defined Radio, the articles about antennas, general construction techniques, etc. hold up well in this era. DLARC in general is a treasure trove of open content, with more content than could be consumed in ten lifetimes. DLARC is a gift to Amateur Radio that will be available in perpetuity.

- My favorite newsletter is the delightfully quirky and hand curated Hot Iron Quarterly by Frank Barnes W4NPN and Peter Thornton G6NGR. Subtitled

  The Journal Of The Constructor's Club, there's always something interesting in each issue. Like YouTube, The Communicator, and 73, Hot Iron is free and accessible to anyone for inspiration and education.

- A dead-heat tie for keeping up with Amateur Radio in general are the weekly Amateur Radio Newsline and Amateur Radio Weekly. Both are projects by volunteers and both provide excellent, consistent content.

While I understand and accept the imperative of *the bills gotta get paid somehow…* in this era, the most urgent issue of Amateur Radio media is *irrelevance* rather than the fear of media being copied and redistributed. That is any niche media that's restricted behind paywalls is already fading into irrelevancy because (as with the surplus of dreck in Amateur Radio YouTube channels) it is *easier and cheaper than it has ever been* to create new content and get it out into the world to advance one's perspective. There are other ways than resorting to paywalls to pay the bills such as (*relevant*, please) advertising, sponsorships, *supporting* (not required) paid subscriptions (*Thank You paid subscribers of Zero Retries!*), periodic fundraisers, merchandise sales, etc.

Yet another future project of Zero Retries is to coalesce a group of (generally, *technically focused*) open Amateur Radio media and make that list easily accessible and regularly updated. And perhaps develop a loose confederation of such media to advertise (cross evangelize) the other members of that confederation. An example of such media that isn't widely known outside its subject area is ATV Journal which covers Amateur (Radio) television. I'm not (yet) into ATV operation, but I learn a lot from reading each issue of ATV Journal.

Given that this is being published in March 2025 and thus we're now well into the applicable year, I think that Part 2 concludes this series.

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ZR > BEACON

By Steve Stroh N8GNJ

Short mentions of Zero Retries Interesting items.

Machine Learning And FreeDV

Presentation (template for others to use) by Mooneer Salem K6AQ first presented at Hamcation 2025:

WHAT IS MACHINE LEARNING?

- A way for a system to generalize based on its training data
- Typically requires a lot of training data (i.e. tens or hundreds of hours of audio)
- Lots of math done during training and inference (i.e. matrix multiplication)
- Traditionally wasn't viable on common hardware even a few years ago
- ChatGPT et al now a click away
- AI-optimized embedded microcontrollers becoming increasingly available

HOW CAN WE USE MACHINE LEARNING FOR DV?

- Better modeling of speech
- Can use previously received audio as well as current audio slice to predict "next" slice
- Help better decode an OTA digital signal
- Modeling various HF propagation conditions during the training process
- Iterate the model based on real world testing

# # #

What Is Vibe Coding? How Creators Can Build Software Without Writing Code

If you've ever had a brilliant idea for an app but lacked the technical skills to build it, 2025 might be your year. There's a new approach to software development that's emerging – one that lets creators with minimal technical knowledge build functional apps, websites, and tools in hours instead of months. Enter: vibe coding!

The days of needing to learn complex programming languages just to create simple software are rapidly fading. With the right AI tools, you can now build a functional app by simply describing what you want – even if you don't know the difference between Python and JavaScript.

I first learned of the term Vibecoding from a 2025-02-27 article in the New York Times - Not a Coder? With A.I., Just Having an Idea Can Be Enough. (paywalled). If you can read the article despite it being paywalled, I recommend it. (I don't remember how I was able to read the entire article despite not being a paid subscriber to NYT.) If memory serves, the article named four AI coding apps that the author found useful in his vibecoding experience.

Vibecoding describes exactly what I've hoped for when AI began emerging as first a "helpmate", then an "amplifier", and now a full blown *enabling technology* for those of us who aren't professional, or even amateur programmers. I think that being able to describe something in logical form, such as writing a detailed specification, may (soon? now?) be sufficient to develop new data communications technologies in Amateur Radio. For example, reference a lot of foundational material such as papers published for the Digital Communications Conferences (even if I don't personally understand them), reference technical specifications of radios and modems (even if this will be a new radio / mode), and then offer provide a detailed specification of how I think (insert favorite high speed data mode) works, perhaps with some on-the-air captures from a spectrum analyzer, and maybe that would be enough to start and critique the inevitable first generation issues. Oh… it would probably help enormously to provide code samples from the many, many modules developed within the GNU Radio framework.

As for me, I'd want to walk the AI through what I want, specify a language (likely Python, since there's so much support for us beginning programmers), refine my idea, simulate my idea, and then have it write all of the code, download that to an SD card, and then run it on the computer / radio combination (two identical endpoints) and see how well / poorly it works… and iterate.

Why be specific about this within Amateur Radio? Because we're allowed to… and encouraged to experiment with radio technology within Amateur Radio.

# # #

inovato is Back - With a New Quadra4K

> Meet Quadra4K: An Incredible Computer That Delivers a Beautiful Gray Line Map at an Amazing Price
>
> Quadra4K runs as a dedicated HamClock appliance on a TV or monitor (1080p or higher). Our HamClock setup program makes this as easy as a few clicks. You can also view your clock in a browser on any Windows or Mac PC, Apple or Android tablet/phone or on a smart TV in your local network.
>
> Now includes almost everything you need: the Quadra4K HamPC, HDMI cable, USB power adapter and power cable. Add a compatible display (and keyboard/mouse if you order without our mini-keyboard).

inovato had a going out of business sale a few months ago as founder Michael Burmeister-Brown N7MDB faced a severe health challenge and decided to close the business, and (I think I recall…) that the supply of the original Quadra units sold out. But things changed - see Inovato Update. I just ordered a Quadra4K to keep a spare monitor busy displaying HamClock in N8GNJ Labs.

# # #

Talented Radio Technology Engineer Available for Hire

Lance Lascari WS2B on LinkedIn:

> Electronics: microwave, RF, wireless, analog, and systems. I can pull off some digital/firmware to get things going.
>
> Specialties: Microwave/RF circuits, synthesizers, radio systems, basic antennas, low-level embedded firmware development, design reviews, digital comms. System analysis (focus on impairments), failure analysis. Highly proficient across multiple design/analysis/simulation domains(Analog, RF, nonlinear, envelope/time, planar, and 3D EM).
>
> RF/microwave solutions that are cost-appropriate for the application. Proprietary or custom digital transceiver design (HF through 30 GHz) is where I feel most comfortable. Some work in low-cost radars.

The link is to WS2B's updated resume. I don't know WS2B beyond the usual, casual "connection" on LinkedIn where he or I "connected" with each other regarding our shared interest in radio technology. I'm not compensated in any way for this mention. He's an Amateur Radio Operator and obviously talented, looking for work in radio technology, and there's a good possibility that such work is available somewhere within the readership of Zero Retries.

# # #

Other Networks Book Now Available for Pre-order

Lori Emerson KF0LCB on her blog:

> At long last, my beloved book, Other Networks: A Radical Technology Sourcebook, is officially available from Anthology Editions for pre-order here! Sadly, despite publishing many gorgeous books, the publisher won't be around for much longer which means there are only 1000 copies available of Other Networks; if you think you'd like a copy, consider pre-ordering as soon as you can manage it.

(Link above is to the book order page.) Book description follows:

> The internet as we know it is not a foregone conclusion. Indeed, the present corporatized, monolithic, surveilled state of our networked communications is just one possibility out of many, and there is radical promise in uncovering hidden alternatives: from pirate radio to barbed wire telegraph, from synthesizers transmitted over the telephone to encoded messages bounced off the surface of the moon. Other Networks is writer and researcher Lori Emerson's speculative index of communications networks that existed before or outside of the internet: digital as well as analog, IRL as well as imagined, state-sponsored systems of control as well as homebrew communities in the footnotes of hacker culture. Featuring explanatory descriptions of each network, archival images, and original artwork by Robert Beatty, Other Networks documents historically alternative networks with a particular eye towards their experimental usage by artists and writers. The result is a boldly creative taxonomy of our networked world, a laboratory sourcebook for readers eager to escape the hegemony of technological history, and a lovingly designed guide to the freedoms and communal possibilities that have been lost along the way.

This really resonates because I lived through a number of networks prior to the dominance of the Internet, which many of the current and future generations assume "has always been there" and is the *only* network.

I have no idea how I discovered KF0LCB's blog, but I've been an avid follower of her articles about "alternative networks" such as A Brief History Of Barbed Wire Fence Telephone Networks.

There's a list of all the networks covered in the book - https://loriemerson.net/books/other-networks/ including:

> **Imaginary Networks:**
>
> - [53] Necromancy
> - [54] Pasilalinic-Sympathetic Compass
> - [55] Telephonoscope
> - [56] Telepathy
> - [57] Ley Lines
> - [58] Mundaneum
> - [59] World Brain
> - [60] Memex
> - [61] Faster-Than-Light Communication Networks
> - [62] Project Xanadu
> - [63] Metaverse
> - [64] The Clacks
> - [65] Pandoran Neural Network
> - [66] Cosmic Internet

Gotta love it! I don't remember the name of the network Arthur C. Clarke posited in 3001: The Final Odyssey (if he did name it) but I'd imagine that such a mention belongs in a future Second Edition of Other Networks. I'd also love to read her treatment of earlier data networks such as ARCNET, SNA, and the US military's AUTOVON telephone network.

I've ordered my advance copy of Other Networks and hope the publisher survives long enough to ship it as promised in April.

# # #

MeshCore

> MeshCore is a multi platform system for enabling secure text based communications utilising LoRa radio hardware. It can be used for Off-Grid Communication, Emergency Response & Disaster Recovery, Outdoor Activities, Tactical Security including law enforcement, private security and also IoT sensor networks.
>
> **Our Mission**
>
> At MeshCore, our passion is building reliable and secure decentralised mesh radio networks for text-based communication. We are driven by the need to empower users in off-grid and disaster-stricken regions with a communication tool that does not depend on the internet or cellular networks.
>
> **Easy to use**
>
> Use our web flasher to install MeshCore firmware on popular devices like the Lilygo T-Deck or Heltec V3 LoRa32, you can also use our web client to communicate securely over radio with other users just using a Chrome web browser - and yes of course it works without the internet!

See also the MeshCore repository on Github.

I don't know what distinguishes MeshCore from Meshtastic other than (I think…) that Meshtastic originated in the US, and MeshCore seems to have originated in the UK. They seem to be independent of each other. Like Meshtastic, MeshCore uses off the shelf LoRa modules and the user interface is apps for Android, IOS, and web. Apologies that I didn't record for attribution where I first learned about MeshCore.

# # #

[FCC] to Explore Alternatives to [GNSS] Systems

Reuters:

> The U.S. Federal Communications Commission said on Wednesday it plans to vote next month to explore alternatives to GPS after national security concerns have been raised about relying on a single system crucial to modern life.
>
> …

> "Continuing to rely so heavily on one system leaves us exposed," FCC Chair Brendan Carr said. "We need to develop redundant technologies."
>
> There have been reports of a rise in GPS interference around the world, particularly since 2023, known as spoofing raising fears of an increased risk of accidents if planes veer off-course.
>
> "Disruptions to GPS have the potential to undermine the nation's economic and national security. And the risks to our current system are only increasing," Carr said, noting President Donald Trump and a bipartisan group of lawmakers have called for action for years.

In my **Request to Send** editorial in **Zero Retries 0177** (2024-11-08), I pretty much predicted this development. With this receptivity from the FCC, NextNav will undoubtedly *double down* with their proposal for a radical reconfiguration of the US 902-928 MHz band to compress / restrict secondary and unlicensed users of that band, ***including US Amateur Radio***, into a small portion of the band.

The next few years will be as opportune a moment as NextNav will ever get to press their case for their proprietary technology, their (paid only) Precision Navigation and Timing (PNT) services, and their (allegedly required) reconfiguration of 902-928 MHz. So… US Amateur Radio, *brace for potential impact*.

For background, see the relevant articles in the following issues of Zero Retries. Click and search for "**NextNAV**" or click on the relevant articles in the contents at the beginning of the issue:

- **Zero Retries 0164**
- **Zero Retries 0165**
- **Zero Retries 0167**
- **Zero Retries 0168**
- **Zero Retries 0169**
- **Zero Retries 0170**
- **Zero Retries 0171**
- **Zero Retries 0177**

I'll add the consolidation of all of these articles into a single article or special issue of Zero Retries to my ever-growing Zero Retries task list.

While the US Department of Defense Global Positioning System (GPS) is not the only Global Navigation Satellite System (GNSS)3 in use… it is the only one *directly under the control and influence of the US government*. The most notable GNSS system other than GPS is the European Union's Galileo system, and all modern GNSS receivers also receive (and interpolate) GNSS signals from both GPS and Galileo. We used to have alternative positioning and timing reference systems - LORAN, WWWV and WWVH, etc.

Related - Stuff You Should Know podcast - How GPS Works. The hosts are a little fuzzy on the basics4, including that by design, GNSS receivers are *entirely passive*, but overall it's an interesting 48 minutes of listening.

Related (but confused) - Planes are having their GPS hacked. Could new clocks keep them safe? This article discussed new developments in precision timebases that can replace the choice to use GNSS signals as a (cheap) source of precision time reference. But they don't point out that GNSS signals isn't the only, or even the best source of precision time reference… the only reason to use GNSS signals is that they work, and GNSS receivers are cheaper than standalone precision time references.

But merely having an independent precision timebase doesn't negate the need for *position reference* provided by GNSS signals. But fortunately, there are a number of advancements in Inertial Navigation Systems, which would negate the need for (external) GNSS signals.

For large systems like aircraft, ships, and military vehicles, reliance on GNSS systems for position data isn't a requirement - *it's merely a cost effective choice*.

# # #

Ohio Packet Wiki

> **Welcome to Ohio Packet!**
>
> We are here to help new and veteran users alike. From APRS, BBS, TCP/IP, Net/Rom, wiring diagrams, software and everywhere in between, we are here to help!
>
> One of the biggest challenges as a newcomer is finding neighboring systems to link to. With so many frequencies, baud rates and protocols, the task of finding a neighboring Node, BBS, Digipeater, etc can be daunting. The main objective with this site is to allow users and Node/BBS operators from all around the state publish information about their systems and get in touch with others who wish to help or create links. Feel free to navigate around and add anything you see fit. The purpose of the wiki is to allow anyone access to update and share information. Due to trouble with spam postings, it is required that you register prior to making edits. None of your information will be shared with anyone for any reason.

Apart from my fondness of being a former Buckeye with my first experiences with Amateur Radio Packet Radio occurring in the Cleveland, Ohio area5, and that I remain intensely interested in all things Amateur Radio data communications, *this wiki* strikes me as being a highly accessible and usable presentation of the relevant information that a newcomer would need to get connected (yeah, pun intended) into Amateur Radio data communications networks in your area. Anyone can quickly get up to speed with adding or updating information in a wiki - no "web development" background needed, or reliance on a single individual to "update the website".

Leave a comment

Share

Comments Summary From Previous Issue

Comments from Zero Retries 0191

- Interest in the Bald Yak project.
- Boots on the ground report on the use of Amateur Radio in the recent flooding disaster in North Carolina.
- Icom D-Star DD Mode included with the Icom IC-9700 and IC-905 radios.
- Kenwood TH-D75A - PTT over Internet.
- Compliment on the new Zero Retries store.

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Zero Retries Boilerplate

The **Zero Retries Store** is now open for business with quality Zero Retries branded merchandise and items being retired from Steve's N8GNJ Labs.

These bits were handcrafted (by a mere human, not an Artificial Intelligence bot) in beautiful Bellingham (The City of Subdued Excitement), Washington, USA, and linked to the Internet via **Starlink *Satellite* Internet Access**.

See the **Zero Retries Boilerplate** page for significant acknowledgements and other information relevant to Zero Retries. For new readers of Zero Retries, that page, and the **About Zero Retries** page has useful information to check out.

My ongoing ***Thanks*** to:|
Tina Stroh KD7WSF for, well, *everything!*
Jack Stroh, Late Night Assistant Editor Emeritus
Shreky Stroh, Late Night Assistant Editor In training

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Footnotes for this Issue

To see the relevant sentence for the footnote, just click the footnote number.

1

Per ChatGPT:
The first known amateur radio VHF repeater was likely the WR2AAA repeater, which was installed in 1955 on the Empire State Building in New York City. This early repeater operated on 145.27 MHz and was an experimental system built by the Long Island Mobile Radio Club (LIMARC) and the Radio Relay League (ARRL).

2

Admittedly, I do not make a deep dive of overall Amateur Radio demographics and trends as does Frank Howell K4FMH (*recommended*). Of necessity, I focus my limited energy, attention, and time on areas of interest to Zero Retries (Zero Retries Interesting) such as the rise of Hackers, Makers, IT professionals interested in networking, etc. into Amateur Radio, all of which is generally "outside the norm" of Amateur Radio demographics.

3

GNSS is the most widely used descriptor for such systems, but some US government publications (see https://www.gps.gov/spectrum/foreign/) refer to global satellite based navigation systems as Radionavigation Satellite Service (RNSS).

4

Completely understandable given the incredibly wide range of topics that the Stuff You Should Know hosts cover. They have more cognitive bandwidth than I ever did.

5

A statewide Packet Radio network for Ohio was still in the fantasy stages when I relocated from Cleveland, Ohio to the Seattle, Washington area in late 1987. I'm glad that "OhioNet" became a reality.